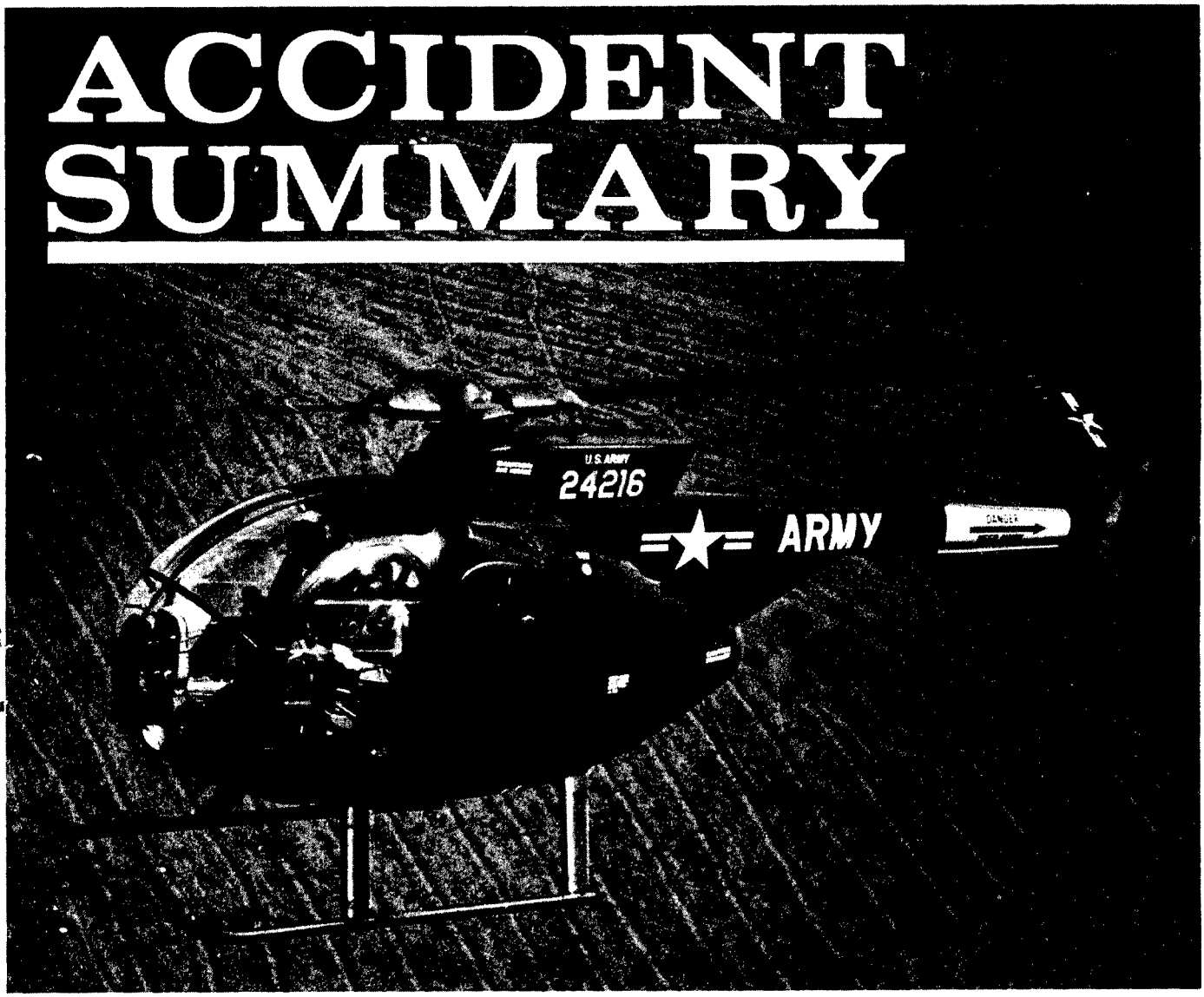
MAJORS, MINORS, INCIDENTS, FORCED LANDINGS, AND PRECAUTIONARY LANDINGS, 1 FEB 65 - 30 JUNE 67

Forbes copy

OH-6A ACCIDENT SUMMARY



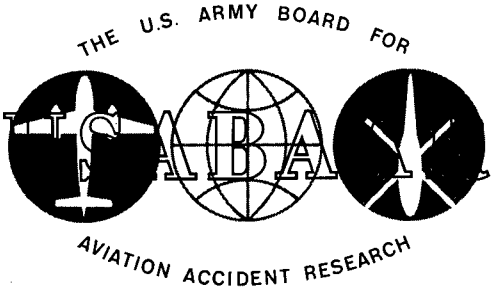
PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH, FORT RUCKER, ALABAMA

OH-6A ACCIDENT SUMMARY

1 February 1965 through 30 June 1967

by
William P. Christian

Investigation and Engineering Division
Engineering Branch



COLONEL RUSSELL P. BONASSO
Director

INDEX

OH-6A ACCIDENT SUMMARY

1 February 1965 Through 30 June 1967

INTRODUCTION

This summary contains all mishap data for the OH-6A since its introduction into the Army inventory through 30 June 1967. It is intended to help commanders develop programs and procedures to prevent accidents. It is also intended to help aviation research and development activities through elimination of similar problems in future aircraft design.

The word *mishap* as used in this summary includes accidents, incidents, forced landings, and precautionary landings.

Briefs of mishaps and cause factors are included to illustrate the types of mishaps which occurred during this period. Each brief is preceded by a USABAAR log number so that queries may be directed to USABAAR if additional information is desired.

Comments and recommendations on ways to improve the usefulness of this summary are invited.

SUMMARY

Of the 31 mishaps which occurred during this period, nine were reported as major accidents. Three of these occurred during test and evaluation programs. Incidents, forced landings, and precautionary landings accounted for the remaining 22 mishaps.

The OH-6A accident rate per 100,000 flying hours was 151.7 for this period. This rate excludes the three major accidents which occurred during test and evaluation.

The total cost of accidents reported was $206,661. Of this, 65% ($134,700) resulted from the three accidents during test and evaluation.

Materiel failures or malfunctions were involved in 20 (64.5%) mishaps; crew factors in five mishaps; supervision ih one mishap; a bird strike in one mishap; and foreign object damage in one mishap. Cause factors for the remaining three mishaps are unknown.

The majority (67%) of the major accidents involved tail boom strikes. All tail boom strikes occurred during the touchdown phase of autorotations.

MAJOR ACCIDENT RATES

The OH-6A accident rate was computed on the number of accidents per 100,000 flying hours. Six major accidents occurred during 3,956 flying hours, for an accident rate of 151.7. This rate does not include three major accidents during test and evaluation programs.

INJURIES

Seven crewmembers sustained injuries during two major accidents. Six had minor injuries and one had major injuries.

CAUSE FACTORS

Materiel failures and malfunctions accounted for 64.5% of all cause factors. Batteries were the leading cause of materiel failures. Fuel control governors malfunctioned most often.

Crew factors were responsible for only 16.1% of the total cause factors. However, the configuration of the OH-6A and incorrect crew techniques resulted in six accidents in which tail booms were severed by main rotor blades. All tail boom strikes occurred during touchdown autorotations. Major cause factors were incorrect autorotation technique and the close proximity of the main rotor blades to the tail boom.

Following are cause factors for all mishaps:

MATERIEL FAILURE OR MALFUNCTION

Failure of inertia damper assembly.....1

Cockpit bubble failed due to designed thickness.....2

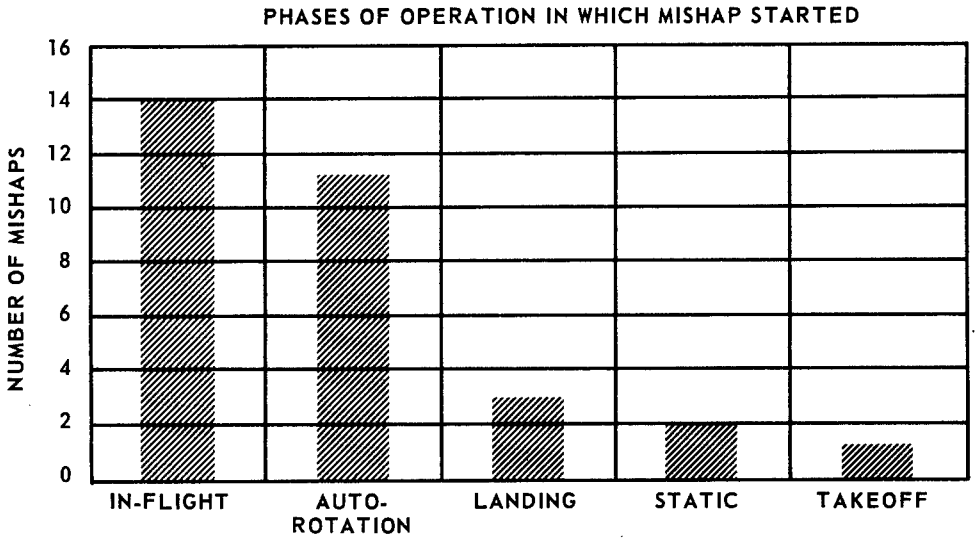
TABLE 1
OH-6A Mishap Classifications

FY	MAJ	INCD	F/L	P/L	OTHER*	TOTAL
1965	1	1				2
1966	1	4		1		6
1967	7	3	4	8	1	23
TOTAL	9	8	4	9	1	31

*Mishap was reported as "other" when engine failed because of FOD.

TABLE 2
Mishap Cause Factors

CAUSE FACTORS	MAJ	INCD	F/L	P/L	OTHER	TOTAL
Materiel Failures	1	4	3	7	1	16
Crew Error	3	2				5
Materiel Malfunction	2	1	1			4
Unknown	2			1		3
Other		1		1		2
Other Personnel Error	1					1
TOTAL	9	8	4	9	1	31



The inflight phase accounted for approximately 45% (14) of the total mishaps. Autorotations accounted for approximately 35% (11) mishaps. The remaining 17 mishaps occurred during takeoffs, landings, and static positions.

FOD to engine due to failure of exhaust collector.....1
Engine failure due to unknown FOD.....1
Failure of engine access door hinge.....1
Failure of chip detector plug.....1
Battery failure.....6
Fatigue failure of compressor blades.....1
Engine stoppage due to fuel starvation, caused by absence of baffles in fuel tank.....1
Design deficiency of cargo door latch allowed door to come off in flight.....1
Throttle linkage out of rig. Suspect improper maintenance.....1
Engine fuel governor malfunction.....2
Engine failure, cause undetermined.....1

CREW FACTORS

Misuse of cyclic control.....1
Misuse of collective pitch control.....1
Failure to level helicopter prior to touchdown.....1
Instructor pilot failed to take corrective action in time to prevent accident.....1
Failure to abort operation in hazardous area of height-velocity curve in time to prevent accident.....1

OTHER PERSONNEL FACTOR

Skid caught on PSP concealed by high grass.....1

OTHER CLASSIFICATIONS

Foreign object damage to engine (on ground).....1
Bird struck landing light.....1

PROBLEM AREAS

Problem areas found during this reporting period and actions taken to prevent recurrence were:

Battery failures—Six battery failures resulted in precautionary landings. Batteries overheated and caused odor and smoke in the cockpit. Some batteries caught fire, but no aircraft fires resulted. New batteries, with improved cells to prevent overheating due to arcing between cells, have been programmed for installation in all aircraft when available.

Armor protection kits—Armor protection kits for pilot's and copilot's seat positions presented problems, including collective pitch stick movement restrictions; cyclic stick hand grips striking pilots' legs; and entrance and exit restrictions with seat armor side plating installed. The restrictions on collective and cyclic controls have been corrected through design changes. Entrance and exit problems remain to be solved.

Collective pitch friction—Two cases, which did not result in mishaps, were reported in which the collective pitch stick locked due to malfunctions of the friction device. Friction assemblies are being revised by an Engineering Change Proposal to correct this problem.

Antitorque pedals—Due to several pedal failures, a daily inspection was required and pilots were warned about:

Using excessive pedal.
Rapid antitorque reversals (kicks).
Pushing both pedals simultaneously.
Pressing pedals while entering or exiting. An Engineering Change Proposal No. 0407, approved 10 July 1967, will strengthen these pedals to solve this problem.

Fuel control governor malfunctions—Two major accidents were caused by contaminated fuel control governors. Contamination in one case resulted from a small piece of the nylock insert clogging up the Py nozzle due to a manufacturing quality control problem.

Door latches—Two cases of engine access doors coming off and one case of a cargo door coming off were reported. Engineering action has been taken to provide new latches to solve this problem.

Intake ducts–Bird nests and grass were reported collecting in and blocking engine air intake ducts. A recommendation for frequent inspections of air intake ducts to solve this problem was published in the WEEKLY SUMMARY.

Oil cooler blower scroll–Large amounts of water have been reported collecting in the oil cooler blower scroll mounted on the bottom of the main rotor transmission. If water is not removed, it could result in corrosion and failure of the cooling system fan assembly. A warning about this condition and a recommendation for inspection and removal of water were published in the WEEKLY SUMMARY.

Pilot and copilot door latches breaking–ECP for new latches has been initiated.

Improper fuel control rigging–Additional maintenance training for proper rigging appears to have solved this problem.

Flight restriction with aircraft doors removed–This condition has been improved, but remains to be solved.

Low fuel flight restriction due to lack of fuel tank baffles.

Uni-Ball coating flaking off–Improved quality controls appears to have solved this problem.

Improper inspection of tail rotor drive shaft after hard landings.

Failure to inspect blade droop stops and striker plates for damage.

MISHAP BRIEFS

Some cause factors are listed as "unknown" in the following mishap briefs. Cause factors are known for some of these, but reporting units have failed to provide supplemental data. To make accident summaries more meaningful, cause factors must be reported when supplemental data is available.

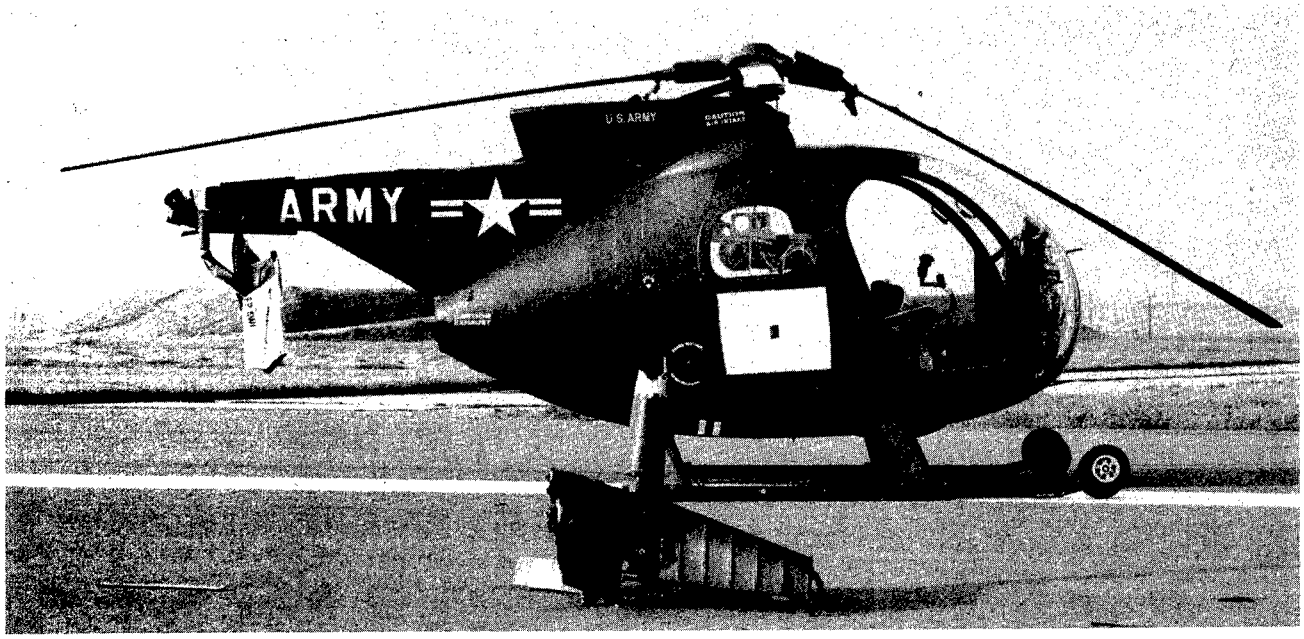
Selected Major Accident Briefs

B425–Instructor pilot moved helicopter onto grass to demonstrate running takeoff. As he started, the helicopter moved approximately 180 feet and the left skid hit a 10-foot length of pierced steel planking (PSP) hidden in tall grass. The left skid was torn off at the strut attaching points. The aircraft was then landed on cotton mattresses to prevent further damage.

CAUSE–IP failed to make recon of area before starting takeoff. Improperly maintained PSP markers were obscured by tall grass.

RECOMMENDATIONS–The board recommended that all aviators be instructed to thoroughly recon all sod areas before using them for takeoffs and landings. It also recommended frequent inspection and proper maintenance of all PSP markers.

E252–A test pilot, with a flight test engineer aboard, was making a practice autorotation. The maneuver appeared normal to the pilot and qualified ground observers. The helicopter touched down in a near level attitude with minimum forward speed. Immediately after touchdown, a main rotor blade struck the tail boom, severing the tail section and damaging the main rotor. The landing was made on a smooth hard surface runway. The helicopter slid approximately 14 feet from the point of touchdown and turned 20° to the left of the runway heading. The engine was



E252

shut down and the main rotor allowed to stop before the crew got out.

CAUSE–Pilot technique of immediately lowering collective and applying aft cyclic control after touchdown, coupled with the sink rate, slight nose high attitude, and low rotor rpm, resulted in the main rotor striking the tail boom.

RECOMMENDATIONS –The board recommended: 1. A timely analysis of available data be accomplished to identify possible problem areas for future testing. 2. A means of determining clearance between the rotor blades and fuselage be employed when conducting tests of this nature. 3. A more accurate means of providing the pilot with information on absolute altitude and wind be incorporated in future testing involving critical maneuvers. 4. A warning type paragraph be included in the OH-6A Pilot's Handbook concerning the possibility of the main rotor blade striking the tail boom during autorotative maneuvers.

COMMENTS OF REVIEWING OFFICIALS–1. Involved personnel will be instructed to jointly evaluate all recorded data to insure that no pilot trends are developed that are in conflict with current operating techniques or limitations. 2. Study will be conducted to develop methods to improve current testing techniques, with an objective to determine when critical situations are approached, to insure critical clearances are satisfactory during expansion of aircraft flight envelopes. 3. The following warning will be included in the OH-6A -10, "Do not lower collective pitch or pull aft cyclic after touchdown until aircraft comes to rest." 4. The testing activity does not consider the clearance between the main rotor blades and the tail boom of the OH-6A critical, when compared to other operational helicopters. In the design of helicopters, rotor blade clearance is given major consideration, consistent with other design criteria, such as aerodynamic interference, performance, stability and control, silhouette, and cost. In the case of the OH-6A, the designer was able to eliminate a gearbox in the directional control system by the design of the tail boom. This design does not compromise the interference problem and resulted in a considerable saving to the government. To increase the clearance would require a major redesign. Prior to this accident, the OH-6A had progressed through the contractor's development tests, FAA certification, which included limited height-velocity work, and through Army evaluation without any reported instances of blade-tail boom interference. This accident revealed that under some conditions, blade-tail boom interference is possible. It is considered that an appropriate warning in the OH-6A -10 should be included, warning the pilot of the possibility of the main rotor striking the tail boom with certain control inputs during autorotation landings. Although major redesign is not considered a requirement, based on the OH-6A experience to date, it is recommended that future OH-6A testing include determination of any problems of blade-tail boom clearance during hard touchdowns within the design limits of the landing gear.

67051220–The IP and pilot took off with a gross weight of 2,340 pounds, 60 pounds under maximum gross weight. The accident occurred during a practice touchdown autorotation after 30 minutes of flight. The autorotation was made to the sod area between two runways. The aircraft landed in a tail low attitude. When it rocked forward, the main rotor blades

67051220

flexed down and severed the tail boom. The empennage arced upwards and forward into the main rotor disc. Skid marks on the ground showed the aircraft slid 55 feet after touchdown. It came to rest in an upright position on a heading of 130°, 10° left of the runway heading.

CAUSES–Instructor pilot allowed aircraft to land tail low. He did not demonstrate procedure for autorotations with loads before allowing pilot to practice autorotation with load. Probable factors were: Skid shoes used on the OH-6A create excessive drag on sod touchdowns. Main rotor blade clearance over the tail boom is less than desired.

A nonrelated factor was found in the engine access door latch. It was found that it can open because it does not have a positive safety latch.

RECOMMENDATIONS–The board recommended: 1. All instructor pilots be directed to comply with the printed syllabus of instruction. 2. The OH-6A Standardization Guide, paragraph 2, lines 3-34, and TM 55-1520-214-10, be reviewed to determine whether the operating techniques now used are satisfactory for the aircraft. 3. An improved skid shoe be designed for the OH-6A. 4. A positive safety latch be developed and installed on OH-6 engine access doors. 5. An engineering study be conducted by higher headquarters to establish a minimum safe blade clearance over the tail boom that can be measured by ground crewmen on a periodic basis.

COMMENTS OF REVIEWING OFFICIALS–All reviewing officials concurred with the findings and recommendations of the accident investigating board. The responsibility of the IP to adhere to the approved syllabus of instruction and to take timely corrective action during all maneuvers is constantly emphasized. The OH-6A Standardization Guide is currently being revised. Urgent EIR's 67-378 and 67-626 have been submitted on OH-6A engine access doors. Further action by higher headquarters is required on recommendations 3, 4, and 5.

The following actions relating to the above have been initiated: 1. All OH-6A helicopters have been equipped with smooth skids. 2. An EIR project has been established and the manufacturer is presently developing an Engineering Change Proposal (ECP) to provide improved engine compartment door hinges and positive safety latches. 3. Urgent TB 55-1520-214-20/9, 22 May 67, required an immediate inspection to determine rotor blade droop angle. If the blade droop is more than 6°, washers are installed on three bolts between spacer and striker strip, to adjust droop to range from 5° to 6°. 4. A probable or suspected cause factor that should be considered in this accident is the execution of a practice touchdown autorotation at near maximum gross weight at a high (2,550 feet) density altitude and in a crosswind. Combined, these elements reduced the margin for error.

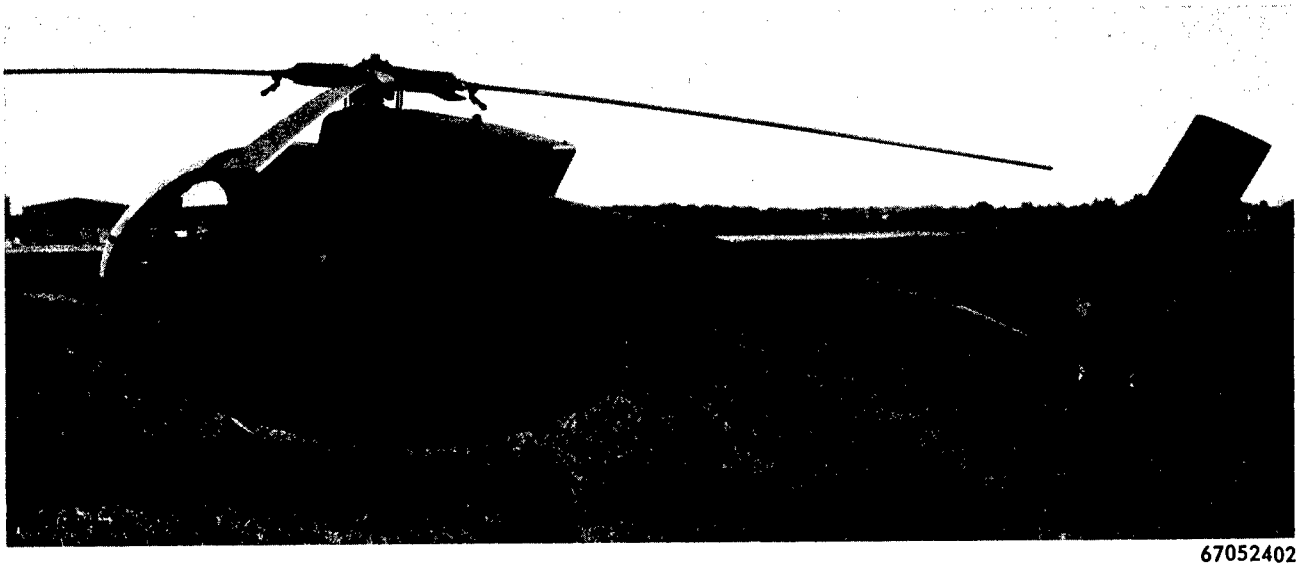
67052402–Engine instruments indicated normal on final for practice 180° autorotation. The pilot started his flare at approximately 60 feet and made his initial pitch pull at 10-15 feet. He then cushioned his touchdown with additional pitch. It appeared smooth and normal. As the aircraft neared the end of its ground slide, the engine reportedly surged. Collective pitch was approximately two-thirds to three-quarters of the way in the up position at this point. At the same time as the reported power surge, the aircraft became airborne and began turning rapidly to the right. The IP took control and applied full left pedal, with no apparent response. The aircraft continued to spin before striking the ground on the left rear skid in a tail low attitude. The tail boom skid hit the ground, twisting the tail boom, and causing the tail rotor to strike the ground. The aircraft bounced into the air and continued to turn to the right. The throttle was checked to insure it was in the flight idle position, but the engine continued to accelerate. The IP reduced collective in an effort to land. The aircraft landed hard, skid heels first, still turning to the right and moving slightly to the rear. It came to rest upright.

CAUSE–The most probable cause of this accident was the instructor pilot or pilot inadvertently applying power during the completion of the autorotation, causing the aircraft to become airborne and uncontrolled.

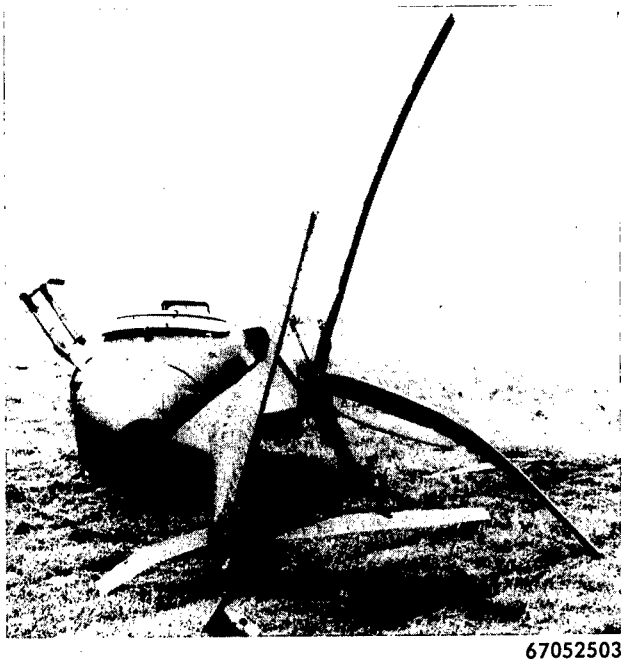
RECOMMENDATIONS–The board recommended: All pilots be cautioned that it is imperative for the throttle twist grip to be held against the idle stops during pitch application for termination of autorotations and that the collective pitch must be full down prior to adding power during all ground roll operations.

COMMENTS OF REVIEWING OFFICIALS–Reviewing officials concurred in the finding and recommendations of the accident board. All OH-6A instructor pilots of the organization were advised of the danger of power application during practice touchdown autorotations. A standardized practice of requiring the pilot to call out, "throttle at the stop," at initiation of the autorotation, at initial pitch pull, and at touchdown has been established.

67052503–The test pilot had been flying for 3 hours, compiling data to verify the height-velocity curve at gross weights of 2,200 and 2,400 pounds. The next phase of testing was started with a change of autorotation entry, airspeed, and time delay. These changes were 30 knots airspeed with a 1-second time delay. Two autorotations, using the above criteria, were made by the copilot. He was not satisfied with the results because he felt they were marginal. The pilot did not consider the copilot's method of acceleration to the desired 50 knot flare speed as the best procedure because he felt the approach angle attitude was too steep. The pilot then entered autorotation at 200 feet agl, indicated airspeed of 30 knots, and a 1-second time delay prior to flight control



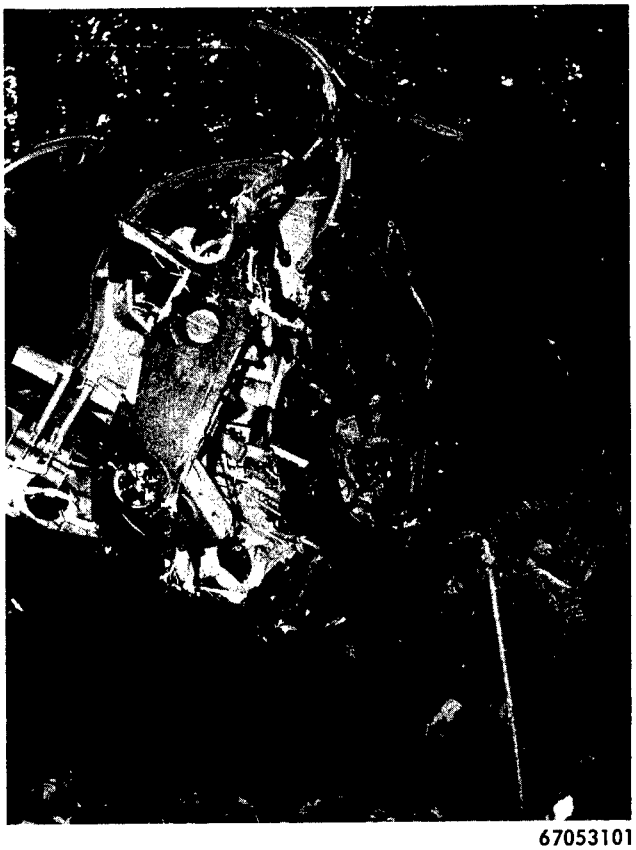
67052402



67052503

movement after chopping the throttle. A lesser dive angle was used to accelerate to the required 50-knot flare speed. This airspeed was never attained. An attempt to flare at an indicated airspeed of 47 knots was discontinued at near level attitude when it was noted that the usual buildup which accompanies the flare was not apparent. The sink rate was high and not abating, so the pilot immediately leveled the helicopter and applied partial collective pitch and full throttle. These actions slowed rate of descent slightly. The aircraft struck the ground in a level attitude with an approximate forward airspeed of 40 knots, fracturing all four landing gear struts. The left skid completely separated, causing the aircraft to pivot to the left more than 360°. It came to rest on its left side.

CAUSE–The cause was determined to be pilot



67053101

technique, while operating in the extremely hazardous area of the height-velocity curve. This technique resulted in an extremely high sink rate. The pilot then attempted an abort. However, recovery was started too late to prevent ground contact.

RECOMMENDATIONS–The board recommended: When test pilots are to determine a helicopter's height-velocity curve, extreme care should be exercised when approaching this critical curve area. Operation in the critical area of the curve should

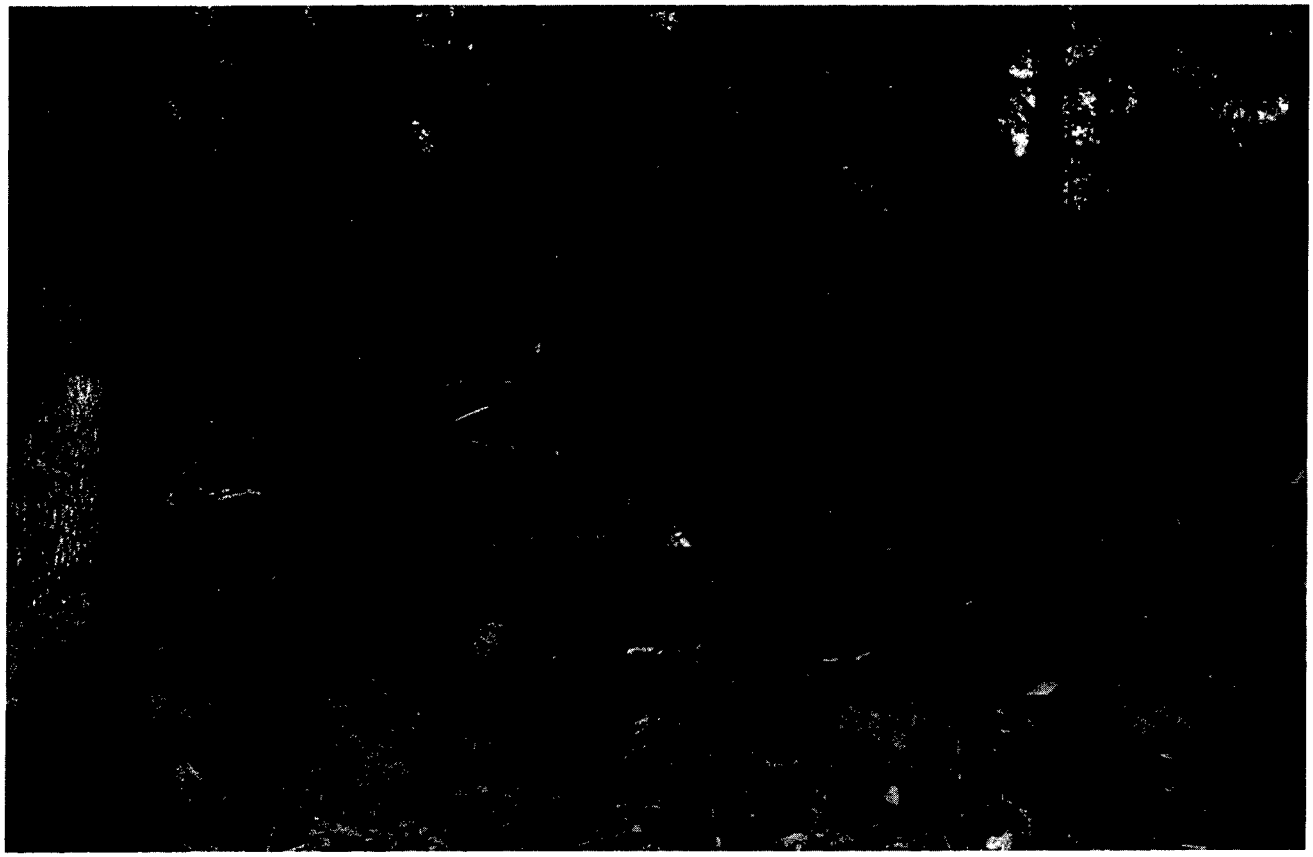
immediately be terminated and the curve established at this point. This marginal area would normally exceed the capabilities of the average pilot's skill and reaction time.

COMMENTS OF REVIEWING OFFICIALS–All assigned pilots and engineers be briefed on the finding and recommendations of the accident board. A slower buildup program should be used as critical flight test areas are approached. An EIR will be forwarded on the pilot's and copilot's seats and pedal brackets. Aircraft damage in this case was the result of landing gear failure. Landing gear failure could have been caused by a hard landing immediately before the accident. To reduce the possibility of recurrence to the minimum, this command will assist the test activity to develop a landing gear load measuring device to be used while conducting height-velocity tests. This device will measure the peak load of each landing and display it in the cockpit, informing the flight crew when landing gear inspections are required.

67053101–The aircraft was following a flight of four UH-1's to the home station at 500 feet when the tailpipe outlet temperature (TOT) rose. The pilot reduced airspeed and power, descended, and continued over heavily wooded terrain. The estimated altitude at the time of engine failure was approximately 200 feet. After the engine quit, the pilot autorotated, terminating at the tops of the trees with minimum forward speed. The aircraft settled into the trees as maximum collective was applied. It fell through the trees from approximately 60 feet and crashed. All four occupants sustained minor injuries.

CAUSES–Engine failure was attributed to a manufacturing defect–fatigue failure of fourth stage compressor blades from oxidation caused by inadequate removal of heat treat scale during production. Failure of these blades resulted in failure of the fourth, fifth, and sixth stages of the compressor. This caused a reduction in airflow, high turbine temperatures, loss of power, then complete engine failure. The pilot elected to continue flying with a high TOT before the engine failed, rather than execute a precautionary landing in the nearest suitable landing area. His decision was based on procedures outlined in TM 55-1520-214-10. He did not maintain altitude or select a flight path to provide access to a suitable forced landing area during an apparent emergency.

RECOMMENDATIONS–The board recommended: 1. Better quality control measures to prevent faulty parts from being installed in engines during manufacture. 2. Emergency procedures in TM 55-1520-214-10 be reviewed to insure precautionary landings are made in the nearest suitable areas when sudden increases of TOT exceed 749° C and load reduction

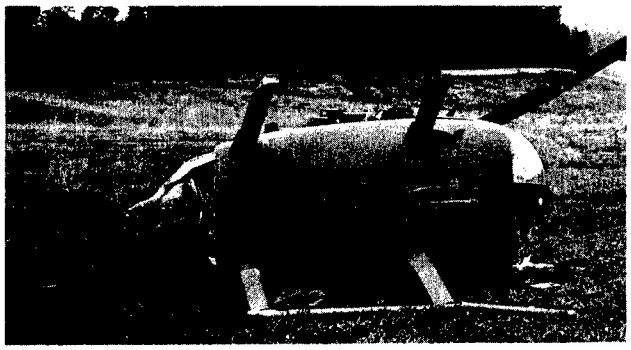


67053101

does not correct the condition. 3. More emphasis on pilot training in selection of emergency landing areas, and in maintaining altitudes that will permit safe emergency landings.

COMMENTS OF REVIEWING OFFICIALS–Concur. Data in TM 55-1520-214-10 concerning tailpipe outlet temperatures may be correct. However, it is not presented clearly. A DA Form 2028 was submitted, recommending changes to the -10. The extent to which pilot error contributed to this accident cannot be determined positively because the time the TOT was above the red line is not known and the availability of precautionary landing areas during this time is unknown. However, it does appear the pilot did not declare an emergency, did not maintain sufficient altitude, and did not change his direction of flight toward open terrain.

67061507–The aircraft was returning from a training flight for refueling. Nearing the airfield, the pilot started a descent. As he did, the rotor and engine rpm increased toward the red lines. The pilot increased collective, called his wingman, and informed him of the difficulty. As he lowered collective to start the approach, the engine and rotor rpm began to increase again. The pilot continued to lower collective to approximately 23 pounds of torque. The aircraft leveled off at 20-30 feet and would not descend. A go-around was made. On the second approach, the pilot used the governor control beep switch and beeped the engine to low range for 10 seconds. He then began the approach by lowering collective. The engine and rotor again went to 110% and 514 rpm and the aircraft would not descend. On the third approach, the pilot used the same technique of keeping the engine down to low range and also closed the throttle to the ground idle position. Again, the aircraft would not descend. On the fourth approach, the pilot attempted to get as low as possible before reaching the field. As he started the approach with the engine beep at low range and throttle closed to ground idle position, the engine and rotor rpm started increasing and the aircraft began a slow climb. The pilot lined the aircraft up with the runway, completely closed the throttle, and entered autorotation. Rotor rpm on entry was 520, altitude was 20-30 feet, and airspeed approximately 40 knots. The pilot began a slight flare at approximately 12 feet and pulled pitch at approximately 6 feet. The aircraft touched down heels low and slid 32 feet before becoming airborne again. During the ground slide, the yellow main rotor blade struck the top of the tail boom, causing it to snap violently. This snap caused the coupling between the tail rotor drive shaft and tail rotor gearbox to separate, resulting in loss of antitorque control. At this point, the aircraft became airborne, possibly from application of aft cyclic. It yawed to the right with the heel of the right skid striking the ground. The red and black blades struck the tail boom and ground, causing the aircraft to spin to the left. It came to rest on its left side.



67061507

67062708

CAUSES–Engine and rotor overspeed due to failure of the fuel control governor. This failure was caused by a small piece of nylon (used as a thread locking device) lodged in the Py bleed orifice. The pilot used poor judgment and technique in starting an autorotation at low altitude and airspeed in the caution area illustrated by the Flight Envelope Curve Chart in TM 55-1520-214-10. Supervisory error was evident on the part of the IP at ground control for advising the low shallow approach.

RECOMMENDATIONS–The board recommended: 1. This accident be brought to the attention of all OH-6 aviators. 2. Positive quality control be established in manufacturing the fuel control unit.

67062708–After completing three demonstration autorotations, IP gave control to the pilot. He entered autorotation. At approximately 50-75 feet, he went into a deceleration attitude to make a zero ground run touchdown. Initial pitch pull was made at 10-15 feet and it appeared the aircraft stopped momentarily at approximately 2 feet, then continued to the ground. Witnesses and pilots stated that it did not appear to be an excessively hard landing. During touchdown, the red blade struck the doghouse and tail boom, breaking the ADF antenna bracket and causing the tail boom to flex up. The black blade

struck the tail rotor drive shaft and severed the tail boom.

CAUSES–IP allowed the pilot to hold centered or slightly aft cyclic during initial touchdown, with possible further aft cyclic movement after touchdown. This, combined with full collective travel prior to touchdown, caused a harder than normal touchdown. Low rotor rpm resulted in the main rotor striking the doghouse and tail boom.

RECOMMENDATIONS–The board recommended: 1. An investigation to determine the feasibility of lowering the doghouse and/or adding a droop in the tail boom similar to the UH-19D. 2. Stricter control over the OH-6A IP techniques and procedures for standardization. 3. All aviators be informed of the proper cyclic control movement for terminating autorotations (forward movement of the cyclic on touchdown). 4. All aviators be made aware of the correct use of collective to insure sufficient remaining movement to cushion touchdowns.

COMMENTS OF REVIEWING OFFICIALS–The reviewing officials concurred with the findings and recommendations of the accident investigating board, except the recommendation for redesign. They stated that proper pilot technique will prevent the main rotor from striking the doghouse and/or tail boom during autorotations.

67063003–After flying 1 hour with one pilot, the IP landed and picked up another pilot without shutting down the helicopter. Six hovering autorotations were made. IP requested and received permission to use the active runway for autorotations because the sod area was too wet. He then let the pilot attempt a straight-in autorotation, entering at 500 feet. Normal deceleration was made to approximately 60 knots, rotor rpm was stabilized in the green, and a decel-

67063003

erative flare was started at 50-75 feet. Initial pitch was applied at approximately 10 feet. The right skid struck the ground at approximately 5 knots forward speed. The helicopter skipped off the ground and left cyclic was applied. Shortly after initial ground contact, the red main rotor blade struck the tail boom, partially severing it. Directional control was lost and the helicopter slid 27 feet from point of initial contact, turning approximately 43° to the right. The engine continued to run and was shut down by the crew.

CAUSES–The static main rotor blade droop angle was 1° out of tolerance due to inadequate inspection. It was suspected that the pilot landed slightly tail low with low rotor rpm, allowing the main rotor blade to flex down and strike the tail boom.

RECOMMENDATIONS–The board recommended: 1. Rigid inspection requirements of the OH-6A static droop angle to prevent recurrence. 2. Acceptance facilities establish procedures to insure the static droop angle is correct before aircraft are accepted and assigned to units. 3. Paragraph 3-34, TM 55-1520-214-10, be changed to include a warning about the possibility of main rotor blades striking the tail boom during touchdown autorotations.

COMMENTS OF REVIEWING OFFICIALS–The reviewing officials stated that the cause of this accident was IP allowing pilot to make improper autorotation. Specific errors were failure to level skids, bouncing at touchdown, improper pitch application which caused low rotor rpm, and the use of aft cyclic. Improperly rigging of the blade droop was considered a possible contributing cause. The extent to which this 1° error contributed could not be determined. Based on hundreds of autorotations and a review of motion picture studies of autorotations, it was felt that this maintenance error contributed only slightly, if at all, to the accident. Concur with recommendations 1 and 2. Nonconcur with recommendation 3. All helicopter pilots are acutely aware of the possibility of striking the tail boom with the main rotor blades on any single rotor helicopter. A more appropriate recommendation would be to correct the deficiency which caused the accident, specifically instructor pilot error.

Selected Incident Briefs

F115–Tail skid hit ground during autorotation and broke off. Caused by improper IP autorotation technique.

G375–Engine turbine blades were damaged because of foreign object entering engine during test and evaluation. Cause of FOD undetermined. Engine was repaired and returned to service.

G426–Engine turbine blades were damaged due to foreign object during test and evaluation. FOD was caused by pieces of metal from a hole in exhaust collector support at lower centerline, just forward of turbine wheel. Engine was repaired and returned to service.

G459–During test and evaluation flight, lower right windshield shattered. Pilot landed immediately without further damage. Caused by inadequate design of cockpit bubble.

C812–Lower right windshield plexiglas disintegrated during straight and level flight at 100 knots. Caused by inadequate design of cockpit bubble.

67032407–Right engine access door came off. Caused by failure of access door hinge fitting assembly.

67033010–Right cargo door came off during autorotation. Caused by design deficiency in the door locking mechanism.

67010604–Left skid caught in PSP mat during landing, damaging left skid and rear support brace. Suspect crew error.

Selected Forced Landings Briefs

67020801–Engine failed at 8,000 feet in 40° right sideslip during an engineering test flight. Helicopter was autorotated and landed on dry lake bed. Suspect low fuel state (85 pounds). The fuel momentarily flowed to the side of the fuel tank, allowing air to enter the fuel line and causing an engine flameout. The pilot did not attempt an air start because he suspected fuel line failure and feared an attempt to start might result in fire. Air was found in the fuel line after the forced landing. No significant engine indications were noted. The N_1 audio and visual warnings came on at 58 percent.

67020909–Aircraft was returning from engineering flight test when engine lost power. Test pilot autorotated to beach. A loud clanking noise was heard prior to shutdown. Cause of engine failure undetermined.

67040808–Battery and generator overheated. Caused by malfunction of battery.

67061306–Engine stopped during practice autorotation. Caused by throttle malfunction. Throttle linkage would not stay in rig.

Selected Precautionary Landing Briefs

G827–Loud noise was heard and vibrations were felt during practice autorotation. Caused by failure of inertia damper assembly, P/N 1615-923-0267.

67040703–Magnetic chip detector warning light came on. Caused by failure of chip detector plug.

67052305–Instructor pilot was performing a 180° autorotation when he smelled and saw smoke. After the helicopter was landed, battery was smoking and boiling over. Caused by battery malfunction.

67060707–Pilot smelled odor, turned off all electrical switches except battery, flew to airfield, and turned battery off on short final. While hovering to parking area, smoke was seen coming from battery compartment. Caused by battery failure. Battery overheated and fused to FM radio.

67062012–During ferry flight, aircraft had a battery fire at 2,000 feet and pilot landed. Another OH-6 ferry pilot landed to assist and his aircraft also had a battery fire at landing. Caused by battery failures.

67062307–Fuzz on tail rotor chip detector plug caused chip detector warning light to come on.

67062610–Instructor pilot saw object through left lower bubble, followed immediately by a thud. Aircraft was landed. Bird struck left rim of landing light.

67062709–Crewchief saw ammeter indicating excessive charge, approximately 140 amps, and increasing. Generator was turned off. Electrical smoke odor was detected 5 minutes later and battery was turned off. Two cells on aft side of battery found ruptured.

67060212–Fire in battery compartment caused by battery failure.

Other

67060503–During a test flight, it was discovered that the engine had foreign object damage during preflight. Cause of the FOD was failure of the blade cuff ejector spring which was ingested into engine compressor section. Protective screen was in place and undamaged. Damage was sustained to the first and second row blades in the engine compressor section.

OH-6A
ENGINEERING CHANGE PROPOSALS
AND
MODIFICATION WORK ORDERS

ECP NO.	TITLE	STATUS	MWO
0001	Fuel vent system	Approved	N/A
0002	Paint system	Disapproved	N/A
0003R2	Stretch plastic windshield	Final approval 19 Sep 67	N/A
0004	Foam in fuel tanks	Disapproved–withdrawn	N/A
0005	1-piece shaft	Disapproved	N/A
0006R1	Heat system	Final approval 1 Feb 67	N/A
0007R1	AN/ARN-83 to replace ARN-59	Approved pending cost	N/A
0008R1	ARC-111 to replace AN/ARC-73	Pending negotiations	N/A
00011R1	Redesigned torque gauge	Final approval Feb 67	55-1520-214-20/1
0013	Relocated ext power receptacle	Approved	N/A
0014	Starting requirement placard	Disapproved–withdrawn	N/A
0017	Removal of static inverter	Approved	N/A
0021	Collective pitch stick	Approved	N/A
0026R2	Heat ducting	Approved	N/A
0028R1	3 pack instruments	Disapproved	N/A
0030	Warning lights	Disapproved	N/A
0032R1	Ventilation system	Approved	N/A
0033R1	Airspeed indicator	Approved	N/A
0034R1	Boost pump	Contractor to reinstall pump	N/A
0035R1	XM-27 armament	Approved	55-1520-214-30/2
0036	Instrument lights	Approved	N/A
0037	Fuel tank barrier assembly	Disapproved–withdrawn	N/A
0038R2	Armor protection	Pending negotiations	55-1520-214-40/1
0039	Rubbing plate	Approved pending negotiations	55-1520-214-30/5
0042	Striker plate	Approved	55-1520-214-30/9
0101R1	Alternate fuel quantity indicator	Approved	Pending

ECP NO.	TITLE	STATUS	MWO
0105	Main transmission shims	Approved	55-1520-214-30/11
0119	Split ring tail rotor	Approved	N/A
0151	Change in paint and marking	Approved	N/A
0153	Trim actuator	Approved	N/A
0156	Hub fairing assy replacement	Approved pending negotiations	N/A
0171	Engine mount bolts	Approved	55-1520-214-30/4
0266	Tail rotor swashplate	Approved	N/A
0372R1	Cargo door and floor	Approved pending negotiations	55-1520-214-30/8
0405R1C1	FM homing antenna	Approved	N/A
0406R1	Tailpipe assembly	Approved	55-1520-214-30/16
0407	Rudder pedal castings	Approved pending negotiations	55-1520-214-30/10
0451	Windshield retainers	Approved	N/A
0477	Blade tracking interrupters	Approved pending negotiations	55-1520-214-20/4
0485	Gun pod switch	See ECP 0035R1	N/A
0505	Fitting ground handling	Approved	55-1520-214-30/7
0509	Strobe light kit	Approved pending negotiations	N/A
0561	Swashplate boot	Disapproved	N/A
0600	Particle separator air filter	Disapproved–withdrawn	N/A
0633	Main transmission pump shims	Approved	N/A
0636	Main and tail rotor transmission lubrication	Approved prod incorp pending	N/A
0637	Horizontal stabilizer tip weight	Approved	55-1520-214-30/6
0645	Armor kits B1 and B2	Disapproved	N/A
0661	Relocate cyclic stick	Approved pending negotiations	Pending
0679	Engine access door latches	Evaluation at ATB	
0689	Step and position light	Disapproved	N/A
0691	Crew and cargo door latch	Evaluation at ATB	
0692	Closure assembly pilot's collective stick	Pending additional field experience	
0701	Tail rotor blade tolerance	Approved	N/A
0736	Hydro-elect torque indicator	Disapproved–withdrawn	N/A
0737	Utility light circuit	Approved	55-1520-214-20/5

ECP NO.	TITLE	STATUS	MWO
0750	Fuel for severe maneuvers	Disapproved–withdrawn	N/A
0753	Plenum chamber cover	Disapproved	N/A
0775	Helmet hanger	Disapproved–withdrawn	N/A
0791	Increased speed trim motors	Prototype testing at ATB	
0906	Main rotor swashplate bearing	Approved	55-1520-214-30/13
0939	Passenger seat belts	Approved	N/A
0948R1	Circuit breaker cover	Approved	55-1520-214-30/15
0983	Redesigned battery	Approved	Pending
0984	Engine access door rigidity	Pending study	
1030	Revised headset and microphone cord	Approved	Pending
1189	Copilot's collective stick fitting	Pending review	
T0001	Magnetic chip detector	Approved	*
T0002	Thermocouple terminal block	Approved	*
T0003	Oil filter housing assembly	Approved	*
T0004	Accessory cover plate and studs	Approved	*
T0005	Mounting studs–tech gen drive	Approved	N/A
T0006	Nitrited oil pump gear	Approved	N/A
T0007	5th stage compressor bleed valve bolt	Approved	N/A
T0009	Torquemeter shaft	Approved	*
T0011	2d stage turbine wheel seal	See ECP T0026	N/A
T0012	Pinned bearing cages	Approved	N/A
T0013	Turbine governor and fuel control	Approved	N/A
T0015R	Carburized gears	Approved pending negotiations	*
T0016	Compressor rotor assembly change	Approved	N/A
T0018R1	Fuel control change	Rejected	
T0019	Turbine lock nut	Disapproved	N/A
T0020	Compressor scroll change	Disapproved	N/A
T0021	Gearbox, self-lock studs	Withdrawn	N/A

*Retrofit to be accomplished at first engine overhaul.

ECP NO.	TITLE	STATUS	MWO
T0022	Fuel control to fuel nozzle change	Approved	55-2840-211-30/1
T0023	Alternate environmental temperature location	Disapproved	N/A
T0024	Turbine support assembly	Approved pending negotiations	N/A
T0025	Vibration damper	Approved	*
T0026	2d stage turbine wheel	Approved	N/A
T0027	Pinion gear bearing change	Disapproved	N/A
T0028	Fuel control and power turbine governor	Approved pending negotiations	*
T0029	Anti-icing valve seal	Approved pending negotiations	*
T0030	Increase in engine dry weight	Disapproved	N/A
T0031	Heat treat No. 1, 3, and 4 turbine wheels	Approved pending negotiations	N/A
T0032	Compressor labyrinth seal	Approved pending negotiations	N/A
T0034	Compound governor	Pending study	
T0035	Fuel pump bronze bearings	Pending study	

*Retrofit to be accomplished at first engine overhaul.

FOR FURTHUR INFORMATION CONCERNING DISTRIBUTION CALL (703) 767-8040

PLEASE CHECK THE APPROPRIATE BLOCK BELOW:

AO #

☐ _____ copies are being forwarded. Indicate whether Statement A. B. C. D. E, F. or X applies.

☒ DISTRIBUTION STATEMENT A:
APPROVED FOR PUBLIC RELEASE: DISTRIBUTION IS UNLIMITED

☐ DISTRIBUTION STATEMENT B:
DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES ONLY; (Indicate Reason and Date). OTHER REQUESTS FOR THIS DOCUMENT SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ DISTRIBUTION STATEMENT C:
DISTRIBUTION AUTHORIZED TO U.S. GOVERNMENT AGENCIES AND THEIR CONTRACTORS; (Indicate Reason and Date). OTHER REQUESTS FOR THIS DOCUMENT SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ DISTRIBUTION STATEMENT D:
DISTRIBUTION AUTHORIZED TO DoD AND U.S. DoD CONTRACTORS ONLY; (Indicate Reason and Date). OTHER REQUESTS SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ DISTRIBUTION STATEMENT E:
DISTRIBUTION AUTHORIZED TO DoD COMPONENTS ONLY; (Indicate Reason and Date). OTHER REQUESTS SHALL BE REFERRED TO (Indicate Controlling DoD Office).

☐ DISTRIBUTION STATEMENT F:
FURTHER DISSEMINATION ONLY AS DIRECTED BY (Indicate Controlling DoD Office and Date) or HIGHER DoD AUTHORITY.

☐ DISTRIBUTION STATEMENT X:
DISTRIBUTION AUTHORIZED TO U S GOVERNMENT AGENCIES AND PRIVATE INDIVIDUALS OR ENTERPRISES ELIGIBLE TO OBTAIN EXPORT-CONTROLLED TECHNICAL DATA IN ACCORDANCE WITH DoD DIRECTIVE 5230.25. WITHHOLDING OF UNCLASSIFIED TECHNICAL DAT \FROM PUBLIC DISCLOSURE. 6 Nov 1984 (indicate date of determination). CONTROLLING DoD OFFICE IS (Indicate Controlling DoD Office).

☐ This document was previously forwarded to DTIC on _____ (date) and the AD number is _____

☐ In accordance with provisions of DoD instructions. the document requested is not supplied because:

☐ It will be published at a later date. (Enter approximate date. if known).

☐ Other. (Give Reason)

DoD Directive 5230.24, "Distribution Statements on Technical Documents," 18 Mar 87, contains seven distribution statements, as described briefly above. Technical Documents must be assigned distribution statements.

Cynthia Gleisberg
Print or Type Name

DSN 558-7924
Telephone Number

Authorized Signature/Date